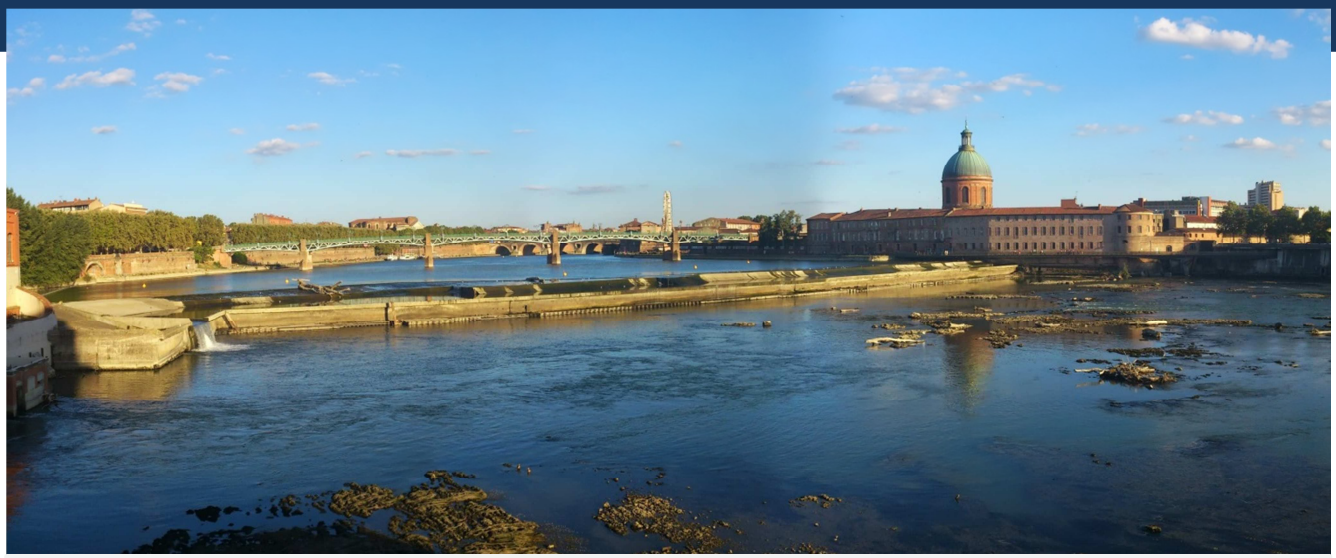

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Mixed-Initiative Planning for Manned-Unmanned Teaming Missions

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Content

The proposed presentation describes an adaptive mixed-initiative agent which assists during mission (re-) planning to enable efficient multi-vehicle mission management. Our application comprises future military manned-unmanned teaming missions. The mixed-initiative agent is capable to plan and schedule tasks of manned and unmanned aircrafts. But instead of replacing the human's role as mission manager, the agent acts as an additional team member and supports the human with task proposals and flaw corrections. Therefore, the agent supports on a level, which was formerly exclusively owned by human operators. The type and extend of support is adapted to the particular situation automatically. By reducing the pilot's work share in the planning process, pilot mental workload can be reduced significantly. However, the probability for lacks in plan awareness increases.

To evaluate the mixed-initiative planner, we implemented it as real-time-capable software modules in a full mission flight simulator. Several crews of experienced pilots of the Bundeswehr conducted a human-machine experimental campaign with the support of the described mixed-initiative planner. Each crew was exposed to five highly dynamic missions in the mission simulator. During these missions, changes of the tactical situation (e.g. pop-up threats) and the mission objective (during flight time) were used provoke high workload situations. We analyzed the overall interaction behavior between the human pilot and cognitive agent using objective measures (e.g. time to pilot's decision, suitability of decisions). Subjective ratings about the parameters of the agent's interventions (necessity, timing, content) and the subjects' trust in the system were evaluated. Results show the advantages and high potential of the adaptive mixed-initiative concept especially in time critical and high workload situations.

The mixed-initiative agent was developed at the Institute of Flight Systems of the University of the German armed forces as part of a five years project which was completed in 2018. The IFS spinoff startup company HAT.tec was founded in 2018 in order to build on the research and to further develop proven concepts and technologies up to and beyond TRL6. HAT.tec currently develops such adaptive mixed-initiative approaches in cooperation with partners from EU industry.

Keywords : Transparent AI, Natural human-machine interaction, Innovative warning systems, Countermeasures, Mixed-initiative planning